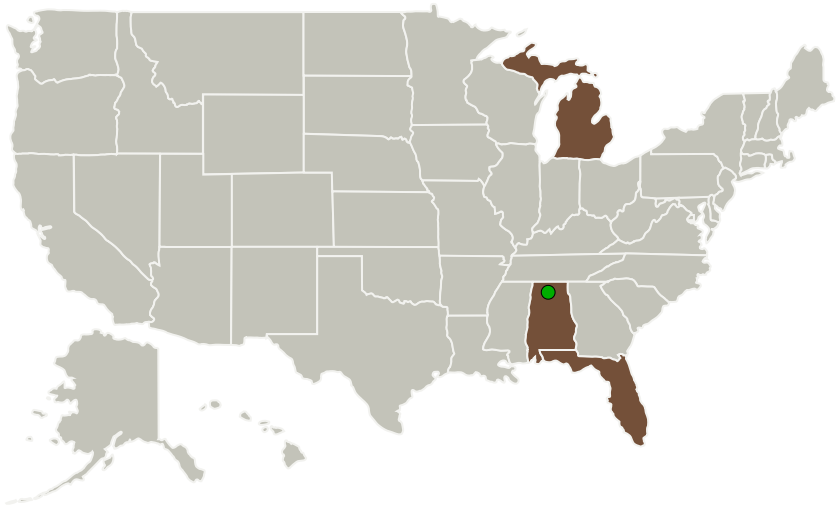
Advanced Unsteady Turbulent Combustion Simulation Capability for Space Propulsion Systems, Phase I

Completed Technology Project (2010 - 2011)

Project Introduction

The innovation proposed here is a high performance, high fidelity simulation capability to enable accurate, fast and robust simulation of unsteady turbulent, reacting flows involving cryogenic propellants (such as LOX/LH2 and LOX/LCH4). The key features of this proposed capability are: (a) Hybrid RANS-LES (HRLES) methodology, and (b) flamelet modeling for turbulent combustion incorporated in a proven existing solver called Loci-STREAM which has been developed by the proposing personnel under funding from NASA over the last several years. The proposed enhancement in Loci-STREAM is anticipated to yield an order of magnitude improvement in simulation turnaround times relative to existing capability for turbulent reacting flow applications. The work proposed here will ultimately result in a state-of-the-art design and analysis tool to enable the accurate modeling of for multiphase combustion in solid and liquid rocket engines, combustion stability analysis, etc. which constitute critical components of versatile space propulsion engines part of NASA's deep space missions.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Streamline Numerics, Inc.	Lead Organization	Industry	Gainesville, Florida
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama
University of Michigan-Ann Arbor	Supporting Organization	Academia	Ann Arbor, Michigan

Primary U.S. Work Locations	
Alabama	Florida
Michigan	

Project Transitions

January 2010: Project Start

January 2011: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140154)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Streamline Numerics, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Siddharth S Thakur

Co-Investigator:

Siddharth Thakur

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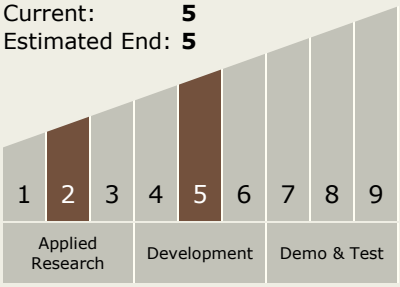
Technology Maturity (TRL)

Start: **2**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.1 Cryogenic Systems
    - TX14.1.5 Cryogenic Analysis, Safety & Properties

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System